

# What's Happening?: Promoting Community Awareness through Opportunistic, Peripheral Interfaces

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## ABSTRACT

Maintaining an awareness of information about one's own community and its members is viewed as being important, but is becoming more challenging today as people are overwhelmed by so many different forms of information. This paper describes the "What's Happening" suite of tools for helping convey relevant and interesting community information to people in a manner that is minimally distracting and disruptive, with little or no user set-up and interaction. The tools are more lightweight than e-mail and Usenet news, and opportunistic in providing information to people when they are not deeply focused on some other task.

## Categories and Subject Descriptors

H.5.3 [Information Interfaces and Presentation]: Group and Organization Interfaces – *computer-supported cooperative work*

## General Terms

Algorithms, Design, Experimentation, Human Factors

## Keywords

Community awareness, opportunistic interfaces, peripheral interfaces, informal communication, CSCW, multimedia

## 1. INTRODUCTION

Community awareness often refers to the degree that people generally know about each other, about social norms and people's different roles within the community, and about issues that affect the community. Maintaining awareness of the on-going changes in the environment and the attributes of people, in-between interpersonal interactions, helps build and sustain social networks, facilitates the collaboration in creative work [8], and contributes to the missing link for achieving the state of "readiness" [23] for such collaborations [2]. When members know a community well, orient toward each other and the group as a whole, and feel a strong sense of attachment to the group, a sense of community is achieved [27].

In a large or geographically separated organization, however, social as well as professional interactions are relatively more diffi-

cult than in smaller, collocated communities, and therefore are likely to be less frequent and less effective. In addition, although a growing amount of information about individual communities is becoming available in electronic forms that enable faster access, it is becoming more difficult to notice and process such information due to our inherent attention limits [28] and the overwhelmingly large amount of information that is available to us [18].

The College of Computing at Georgia Tech is an academic research organization consisting of several hundred faculty, staff, and graduate students in different areas of computing. Due to space limitations, this community grew out of its original home building (HB) to occupy two satellite buildings, SB1 and SB2.

Although SB1 is only a short walk away from HB and SB2 a short drive away, this geographic separation seemed to contribute to several problems. For example, people in the community felt an emerging sense of distance and unfamiliarity, and they worried about the reduced chances for casual interpersonal interactions. In addition, community members wanted better visibility of other people's achievements, better involvement in community events, and better resource sharing. Many people expressed a desire for ways to foster a sense of responsibility among community members and improve the sense of community, even though a certain amount of separation was inevitable given the amount of growth that had occurred.

One might speculate that technology could help improve community awareness in such situations. In particular, a large body of research in Computer Supported Cooperative Work (CSCW) has been focusing on supporting distinct awareness that directly relates to collaborative tasks. These systems often shorten the perceived distances between team members by providing virtual presences of people, enable team members to contribute to targeted products across time boundaries, and offer fine-grained control of collaborative activities [10]. However, these technologies tend to be most effective in organized teams with common goals, where people are already familiar with each other. They often demand a substantial amount of attention from the user and participation often requires the user to spend a considerable amount of effort. Since community awareness is usually only loosely related (or unrelated) to any specific collaborative tasks and the benefits are rarely immediate, using these technologies to maintain awareness at the community level becomes distracting, sometimes even overwhelming.

Unlike solution-seeking groupware systems, as the CSCW systems mentioned above are often referred to, opportunistic interfaces aim to create lightweight and unobtrusive *opportunities* for information discovery and exchange. They present information in a timely manner without distracting the user's attention away from the tasks

at hand. The user can make sense and make use of the information with a minimal amount of effort when such chances arise.

In this article, we introduce “What’s Happening” (WH for short), a set of two systems designed to help promote awareness of information and activities in a local community. Most importantly, the tools seek to do this in an unobtrusive, peripheral manner. The first tool is the WH Communication-Bar, a small corner-of-the-display interface that deliberately cycles through local community and general interest information blurbs that it has gathered. The second tool is the WH Screen-Saver that presents collages of images taken from web pages on the local web servers.

In the next section, we discuss related research. Then we introduce the WH systems, providing design objectives, system functionality, and implementation overviews.

## 2. RELATED WORK

A number of systems have influenced the design of our awareness applications. Buddy lists such as ICQ [13] and Lotus Sametime [17] are applications that show simple online status of remote users through changing font styles or indicators. Irwin [21], the Awareness Monitor [3], and Sideshow [4] aggregate dynamic information from multiple sources and use small graphical tags or views to signal the relevance, magnitude, or urgency of the changes. Ticker-tape [6] as well as the once-popular PointCast and many other commercial “Internet Toolbars” shows information in the edges or corners of computer desktops or in the screen-saver mode.

Calm technologies explore interfaces that stay in the user’s periphery of attention while still providing some value to the user and shift smoothly into the focus when necessary [29]. The water lamps and pinwheels [5] and ambient displays in ambientROOM [14] convey information in the background, using unobtrusive physical objects, reflections, and sound effects. Audio Aura provides auditory cues about tasks and colleagues while the user moves around in the physical work space [22].

Systems such as the Apple On-line Newspaper [16], the Aware Community Portals [26], the UniCast/OutCast/GroupCast trio [20], and the Notification Collage [9] use personal peripheral displays as well as large public displays to bring on-line content into the physical space where people work or pass by.

Our WH web image collage service, described later, was inspired by the CollageMachine [15] and Mandala [11] which used collages to facilitate browsing large sets of images and corresponding web sites. In addition, the WH collage application is related to the Kandinsky System [7] that uses artistic templates with stock images to produce aesthetically pleasing collages that may evoke some level of understanding of the suggested information.

## 3. THE “WHAT’S HAPPENING” TOOLS

Our primary goal in this project was to allow people to discover information about their community in a non-distracting, low effort manner. Particularly, the following objectives drove our directions:

- Provide useful and interesting content. To jump-start participation and minimize user effort, the system should provide automatically generated informative content. The system also should support user-submitted content to allow more personalized direct input.
- Encourage open, cross-group communication. One can help expand people’s social ties by fostering an open environment

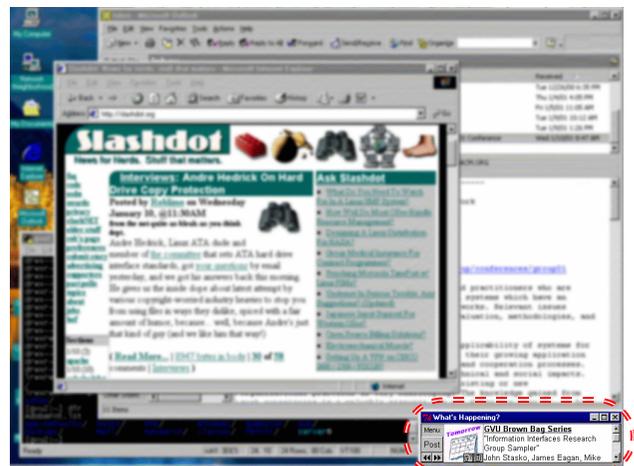
for cross-group communication [25]. In contrast, within-group communication may be better supported by more formal applications such as e-mail systems.

- Exhibit a simple and calm interface. Awareness tools need to stay in the user’s periphery of attention when the person is not directly interacting with them. When the user is paying attention to the awareness application, the interface must be simple enough to allow the user to quickly finish what he or she want to do so the person can return to their primary tasks.

The “What’s Happening” system consists of two main components, the WH Communication-Bar and the WH Screen-Saver. The Communication-Bar was designed to reside on a person’s desktop and use little real estate. It deliberately cycles through pieces of community related or personally interesting information (an early version of the Communication-Bar was briefly described in [31]). The Screen-Saver shows graphics and text excerpts from pages on web sites in the community. Each of these components is described in more detail below.

### 3.1 The WH Communication-Bar

The Communication-Bar’s user interface has a small footprint on a person’s computer display, and is often suitably placed in the corner (see Figure 1). It is designed to remain visible and not be obscured by other windows. The system shows short “blurbs” of automatically collected local content such as official announcements and community events, as well as external ones such as news reports and weather forecasts (see Figure 2 for several examples). Each blurb typically remains active for a day or until it is removed from the corresponding data source. In addition, users can contribute content either by posting new stories or by “following up” on existing content in the built-in chat rooms. A user posting can last from an hour to a week. Chat Rooms, on the other hand, are automatically purged after being inactive for two hours.



**Figure 1. The Communication-Bar at the bottom right corner of the desktop.** It does not use much screen real estate even on this 1024×768 display. In its default horizontal layout, the height of its main window is fixed at 66 pixels while the width is user-adjustable (340 pixels as shown here). The user can choose to lay out the interface vertically, in which case the height will become adjustable and the width will be fixed.

Blurbs are shown one at a time, in a cyclic manner. After displaying a blurb for a user-adjustable amount of time (default of one minute), and without any user input such as scrolling, the system automatically replaces the old blurb with a new one.

The Communication-Bar uses multiple levels of detail in the display of the blurbs. The most prominent visual feature is an image depicting the topic, source, or status of the current information, so that with a quick glance, a viewer can decide whether to pursue the information further or switch to other tasks. A red flag at the top right corner of the image signals that the blurb is being shown for the first time. The title of the blurb and a short summary provide the user with progressively more detailed information. In addition, the title of a blurb signals the scope of the information: local content uses a bold font, external content uses the regular font. Finally, the user can invoke a web browser to see the original full-text article by simply clicking on the title.

Small iconic buttons at the bottom right corner of the content image provide quick access to actions that can be performed on the current blurb. The trash can button removes the blurb so that the program will not automatically show it again in the future, even though the blurb is still stored in memory and can be accessed through a list of available blurbs. The head-and-question-mark button shows the activity level in the chat room for the displayed blurb: the bigger and darker the head, the more recent that someone added to the chat room discussion. Clicking on the head-and-question button retrieves the corresponding chat room (as shown in Figure 2-b), which replaces the chat button with a document button that links the chat room with the web page for the original blurb.

The “Menu” button to the left of the interface displays menu items to pause or resume automatic cycling, list available blurbs, and show the preferences dialog. The preferences dialog allows the user to customize the application such as choosing either horizontal or vertical layout and adjusting the length of the pause when displaying individual blurbs. In addition, users can save the geometry of the application, thus enabling the main interface to appear at a fixed location on the desktop every time the program starts. Finally, the user can select the external information sources to monitor through the interface. Since community related blurbs should have higher priority than those from external sources, local content will always be automatically cycled.

The “Post” button on the main interface displays the post-a-blurb dialog that lets the user submit a new blurb by specifying a title, a brief summary, an expiration time, and an optional web address for any details (see Figure 3). Since the precise moment that a blurb expires in WH is usually not a critical matter, the Communication-Bar presents a few choices of expiration time instead of requiring the user to type in a time, hence reducing the effort involved in posting a blurb. The image shown to the left of the dialog will be displayed along with the submission, providing a space for self-expression (see “zsigs” in Zephyr [1]).

Lastly, the two arrow buttons on the main window allow jumping to the previous or the next blurb in the cycle.

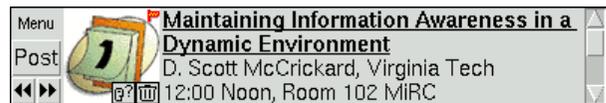
Even though there are many controls in the application, only a few of these, the most frequently used ones, are located on the main interface, thereby simplifying the appearance of the application. Furthermore, the primary method of use is to leave the interface in a corner of the display and let it quietly run. A new blurb replaces an old one in a smooth wiping animation that will be discussed further in the next section. The deliberate cycling of blurbs is meant to

provide users with the opportunity of viewing an item when the person has a free moment or is in-between tasks.

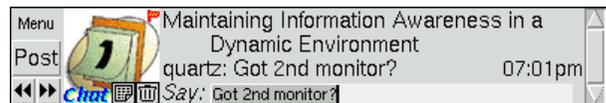
### 3.1.1 Implementation

The Communication-Bar is primarily implemented in the cross-platform scripting language Tcl and its associated user interface toolkit Tk [24]. The awareness system consists of a server program running on a dedicated Unix machine and client programs running on users’ computers. The server handles collecting data and extracting content from local and external sources, broadcasting information to clients, relaying chat messages among the Communication-Bars, and cleaning up old content. The client program is responsible for receiving content from the server, filtering the blurbs according to user preferences, and presenting them in an order that interleaves instances from different sources. The client also submits new blurbs and chat messages entered by the user to the server.

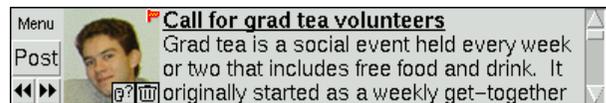
The development of the Communication-Bar was an iterative process. Based on feedback from colleagues and users, we continuously reduced the number and complexity of interactive components on the main interface. For example, one of the early prototypes had a number of buttons for selecting from several categories of content to show. Another prototype used a tree-browser as the main display area for “expanding” or “collapsing” multiple blurbs. To reduce clutter and support quick, peripheral access, these features were later removed or simplified [30].



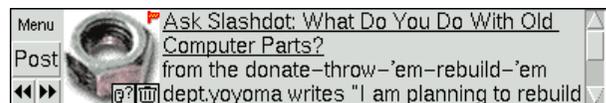
(a) An automatically collected seminar announcement.



(b) The chat room corresponding to the blurb in (a).



(c) A user-contributed blurb.



(d) External content: a Slashdot blurb in this case.

Figure 2. Example Communication-Bar blurbs.

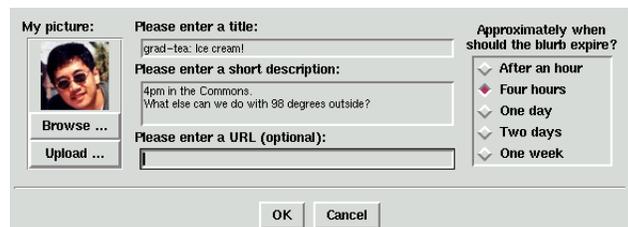


Figure 3. Dialog for posting a new blurb.

How the application transitions from displaying one blurb to the next can affect the level of distraction incurred by the user. We suspected that directly replacing the current display with the new one or using the popular “ticking” animation as seen on TV programming would be distracting and therefore inappropriate. Empirical studies of animations in awareness applications did not exist in the literature during the development of the communication-bar, even though two separate research projects later confirmed our hypotheses on the use of transition animation [19, 21]. As a path-finding experiment, we prototyped several transition animations and presented them to trial users. We found that a wiping animation, which gave the illusion of the old blurb being “wiped” away to reveal the new one underneath, to be the least distracting and thus implemented wiping in the application.

At the beginning of the development process, the Communication-Bar had a small set of automatically generated content items including the community calendar of events, local weather forecasts, and Slashdot news. Based on user feedback during initial deployment, we gradually added more information sources to the application, such as Salon.com news and user-customizable stock quotes from Yahoo!. The content server uses a common XML parser to periodically import content from web sites that have XML backends. For those without XML, we developed *ad hoc* algorithms to extract necessary information from the web pages.

To avoid community-related information being overwhelmed by more general information, it became increasingly important to add local content. However, some types of local information were relatively easy to collect automatically while other types were not. For example, a group of graduate students used a special mailing list to announce “happy hours”, a weekly off-campus social event. We set up an e-mail filtering rule to automatically forward the messages to the WH system.

Conversely, although community-related messages often appear in e-mail and newsgroup messages, developing a program to automatically extract the required information from an arbitrary text and decide its appropriateness for showing in WH is exceptionally challenging (essentially a natural language understanding problem). We use the notion of a content editor. This is a person who chooses and forwards messages such as community related news, events, and discussions not generally available through other communication methods. The coverage and quality of this manually forwarded content will inevitably depend on how well the editor knows the community.

One accompanying objective of the WH Communication-Bar was to support the exchange of information not unlike e-mail or newsgroups, but to be more “lightweight” in doing so. For instance, the Communication-Bar is ideal for posting a message such as “My daughter is selling cookies to raise funds for school. Anyone interested?” Such a message might be viewed as “spam” in e-mail or news, but it is appropriate for WH where the information importance and required user access actions are both less than they would be with the other tools.

## 3.2 The WH Screen-saver

The Communication-Bar provides one form of local information such as announcements and discussions, but there also are other sources of information about a community and its members. One in particular is the set of local web pages about people’s research interests, hobbies, travels, family, etc. With the proliferation of personal web pages though, it has become increasingly unlikely that

people will browse the home pages of other community members. Thus, showing some of the information opportunistically without requiring much effort from the user may provide more chances for people to learn about each other.

While information in a textual form may not be comprehensible to people in a short glance, images usually provide good representations of the content of web pages and they are easier to grasp than text, especially within a short time limit [11]. Therefore, it may be more effective to show the images on the web pages instead of providing details of the text content.

One fundamental problem, however, is that images generally do not fit easily in a small space such as that provided by the Communication-Bar. As an alternative, we decided to utilize a screen-saver as a community awareness tool. First, we designed a server program to generate image collages. Each collage is a large JPEG image composed from smaller images that the server has collected from local web pages (see Figure 4 for an example). The program repeatedly creates different collages and copies each one to a fixed location on the network. Then, we developed a screen-saver client to periodically retrieve those collages from the network and display them on a screen.

### 3.2.1 Image Collection

Since the images embedded in or directly referred from a single web page are more likely to be related, a collage based on these images is more likely to form a consistent message, allowing a casual viewer to get a rough understanding of what the collage is about with a short glance.

To gather the locations of web pages and images on all web servers in the local domain, the WH system schedules a weekly `http://dig` web crawler [12]. Based on the results, the collage server then creates a list of unique web pages that have been modified in the previous 18 months, arranges the list in a random order, and processes each page sequentially. For each web page, the collage server randomly selects items from the set of images associated with that page, ignoring decorative elements such as thin separators and small buttons to reduce clutter, and adds the selected images to a blank canvas to form a collage. If the web page has less than five images, the collage server inserts the first several lines of text on that page into the background of the collage to help convey the topic of the page quickly. If the canvas appears to be full, i.e., the sum of the areas of all the images added to the canvas exceeds a threshold, or if the total processing time for this collage exceeds its



Figure 4. Example local web image collage.

corresponding threshold, the server will stop adding images to the current collage. Lastly, the server draws the title of the page at the top of the collage and draws the location of the page at the bottom. It uses a shadow style to draw the annotations so that they are recognizable on both dark and light backgrounds.

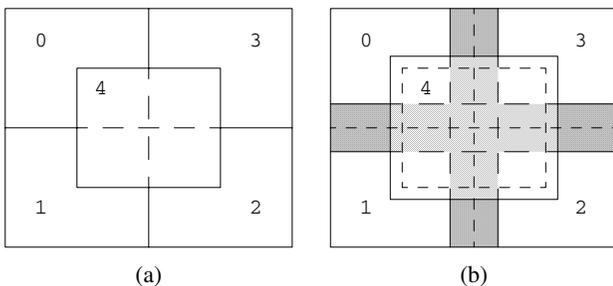
After making the new collage available on the network, the server sleeps for a short period of time to allow the screen-saver clients to update their displays and give the users a chance to see the collage before it is replaced by the next one.

### 3.2.2 Image Layout

The initial collage server simply used the system built-in random number generator to calculate where to put an image into the collage canvas. Since the system random number generator only outputs deterministic pseudo-random numbers, the images tended to overlap and cluster on the collages. The resulting collages did not utilize available space efficiently and often were not aesthetically pleasing.

The current collage server uses a simple layout algorithm to spread out the images on the collages. Conceptually, the algorithm divides the collage canvas into four quadrants and adds a fifth region of the same size to the center of the canvas. The regions are labeled from 0 to 4 as shown in Figure 5-a. In the actual implementation, the algorithm expands each of the five regions by 10% to allow a small amount of overlap across regions as shown in Figure 5-b.

The collage server then adds images to the five regions 0, 1, 2, 3, and 4 sequentially, iterating back to 0 after region 4. For each image to be added, the collage server scales the image down to no more than 90% of the size of the region, if necessary, and places the image at a random location within the selected region.



**Figure 5. Dividing the collage canvas into five regions.** Region 4 is drawn as if it is a semi-transparent sheet. The original regions are shown in (a). The expanded regions are shown in (b) where the dotted lines denote the original region boundaries and the shaded area represents overlapping among regions 0, 1, 2, and 3. Region 4 always overlaps with the other regions.

### 3.2.3 Value-added Collages

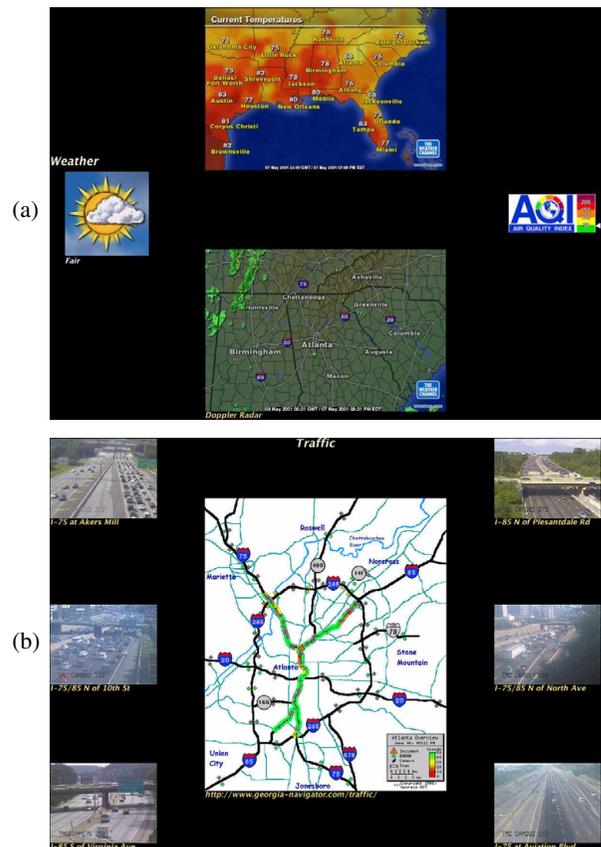
In addition to showing image collages that help people discover parts of the local community web space, the screen-saver gave us a chance to provide value-added services that may opportunistically help viewers in certain aspects of their daily lives. For example, every 40 minutes or so, the collage server generates a weather collage. This collage contains images from The Weather Channel that depict current weather conditions and temperatures, weather radar scans, as well as the current air quality index (Figure 6-a).

Between 4:30pm and 7:00pm on workdays, the collage server builds a traffic collage every 3 minutes (Figure 6-b). The higher frequency provides users increased possibility to observe traffic conditions, which is a more vital task during that time period. The traffic collage contains a traffic map highlighted by average highway speeds. It also includes images from highway cameras so that a viewer can assess traffic conditions visually.

Finally, the collage server is also a client of the WH content server. Thus, it generates a news collage based on a Communication-Bar blurb every ten minutes.

## 4. CONCLUSION

The development of the “What’s Happening” tools demonstrated two example designs of community awareness applications, with an emphasis on providing useful and interesting content through simple and calm interfaces. In addition, this paper contrasted the implications of two design choices — a Communication-Bar that co-existed with other applications on the user’s computer desktop versus a Screen-Saver that had exclusive control of the entire display area. In order to avoid distracting the user from other tasks and give the user a rough estimate of the information in a short glance, the Communication-Bar utilized a small on-screen size, a few simple controls, a layout that supported information presentation in progressive details, and a smooth, gradual animation that minimized sudden changes in appearance when switching from one instance of information to the next. The Screen-Saver, on the other hand, traded the capabilities of customization and screen-sharing in exchange for the advantage of being able to show large images to convey information that was otherwise difficult to



**Figure 6. The (a) weather and (b) traffic collages.**

describe. It focused on creating visually pleasing image collages and mixing image presentations from different sources to let the viewer discover interesting aspects of the community.

The WH Communication-Bar and Screen-Saver have been in use for more than two years. Space limitations preclude an evaluation discussion here. See [30] for a detailed system evaluation.

Our observations of trial system use showed that opportunistic interfaces can convey information in the periphery and unobtrusively enrich one's information space without requiring considerable user effort. In addition, we learned that the effectiveness of community awareness applications depend not only on lightweight interfaces, but also the information content communicated through these interfaces. To foster community awareness, designers should couple awareness technologies with practices in the community culture, such as contributing editors that help create interesting content, set examples for other users, and encourage participation.

## 5. ACKNOWLEDGEMENTS

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